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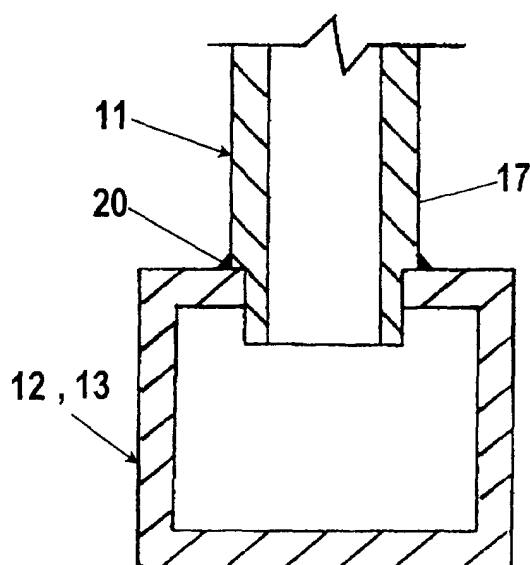
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(54) **Heating device**

(57) The heating device for heating domestic rooms and/or for drying household linens is of the kind intended to be connected to the hot water circuit of a domestic heating system and is provided with an array of horizontal tubular elements (11) which are joined by welding to a pair of vertical tubular elements (12,13). The vertical tubular elements (12,13) are provided with a plurality of bores (16) which are adapted to receive the end portions

(17) of the horizontal tubular elements (11). The end portions (17) of the horizontal tubular elements (11) are provided with a reduced diameter cylindrical portion (18) adapted to be inserted in the bores (16) formed in the vertical tubular elements (12,13). The cylindrical portion (18) has a shoulder (19) at the connection with the outer surface of the horizontal tubular element (11) which is adapted to abut against the edge of the bores (16) during the assembly of the heating device.

FIG. 6



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Description

[0001] The present invention generally relates to the field of heating devices, and particularly a heating device intended for heating domestic rooms and/or for drying household linens.

[0002] Heating devices of the above-mentioned kind are from time known in the art and are presently manufactured in different embodiments.

[0003] According to one known embodiment, the heating device consists of a radiator which is provided with a pair of vertical metal tubular elements transversely connected to each other by means of horizontal metal tubular elements and is placed in domestic utility rooms, such as bathrooms and kitchens, for the purpose of fulfilling particular heating requirements or for keeping linens and towels dry and warm. The heating device is hydraulically connected to the domestic heating system and may be also provided with an electrical resistor for heating the water in the case the domestic heating system is not operating. The vertical and horizontal tubular elements are heated by the hot water flowing therethrough and release heat by convection and radiation inside the domestic room where the heating device is placed.

[0004] The recent years have seen a great development in the field of heating devices for domestic room heating and/or for household linen drying, both from the operative and aesthetical point of view, with the object of meeting particular heating requirements and satisfying a refined aesthetical level which at the present time is demanded for such heating devices.

[0005] The development in this field is therefore aimed, in the first place, at the design of heating devices having unconventional shapes and dimensions in order to make optimal use of the available space in domestic rooms which is generally rather limited.

[0006] Another object which the development in this field is aimed at is the improvement of the technique of manufacturing the heating devices so as to permit high quality products to be manufactured without excessively increasing the manufacturing costs.

[0007] With reference to the latter object, there is at present much scope for improving the technique of connecting the horizontal tubular elements of the heating device to the two vertical tubular elements. Usually, this technique consists in inserting the end portions of the horizontal tubular elements of the heating device in suitable bores formed in the vertical tubular elements and to fixedly join each horizontal tubular element to the vertical tubular elements by means of a welding operation, for instance a tungsten inert gas (TIG) arc welding operation, a braze welding operation or a laser beam welding operation.

[0008] Each end portion of the horizontal tubular elements undergoes a forming process by which a substantially frusto-conical shape is imparted thereto which makes their insertion in the relevant bore formed in the

vertical tubular element easier.

[0009] Although such frusto-conical shape of the end portions of the horizontal tubular elements has the advantage of making the assembly of the heating device easier, it has however the disadvantage of not permitting a high quality finish of the heating device to be obtained because a gap between the edge of the bores in which the end portions of the horizontal tubular elements are inserted and the outer surface thereof is formed due to the reduction of diameter at the end portions of horizontal tubular elements. This gap is filled with weld material used during the welding operation. For cost reasons, the quantity of weld material applied to the joints is quite small and therefore the gap is clearly visible even if the finished heating device is not closely inspected, thereby imparting the heating device the appearance of a coarsely manufactured product.

[0010] The object of the present invention is to obviate the aforesaid disadvantage by providing a heating device of the above mentioned kind wherein the horizontal tubular elements intended to be joined to the vertical tubular elements are configured so as to attain a higher assembly quality in the manufacture of the heating device.

[0011] More in particular, the heating device for heating domestic rooms and/or for drying household linens is of the kind intended to be connected to the hot water circuit of a domestic heating system and is provided with an array of horizontal tubular elements which are joined by welding to a pair of vertical tubular elements, wherein the vertical tubular elements are provided with a plurality of bores which are adapted to receive the end portions of the horizontal tubular elements, and is characterised in that the end portions of the horizontal tubular elements are provided with a reduced diameter cylindrical portion adapted to be inserted in the bores formed in the vertical tubular elements, the cylindrical portion having a shoulder at the connection with the outer surface of the horizontal tubular element which is adapted to abut against the edge of the bores during the assembly of the heating device.

[0012] The features of the present invention will be better understood from the following description in connection with the accompanying drawings, wherein:

Figure 1 diagrammatically depicts a front elevation view of a hot-water heating device provided with the horizontal tubular elements according to the invention;

Figure 2 is a partial side elevation view of a vertical tubular element of the heating device of Figure 1; Figure 3 is a sectional view taken along line III-III of Figure 2;

Figure 4 is a partial longitudinal sectional view of a first embodiment of the horizontal tubular element of the heating device according to the present invention;

Figure 5 is a partial longitudinal sectional view of a

second embodiment of the horizontal tubular element of the heating device according to the present invention; and

Figures 6 and 7 are sectional views of a vertical tubular element of the heating device with a horizontal tubular element according to the present invention connected thereto.

[0013] With reference to Figure 1 of the drawings, there is diagrammatically depicted a heating device, generally designated by 10 and intended to be installed in domestic utility rooms, e.g. bathrooms and kitchens, for heating purposes or for keeping household linens and towels dry and warm.

[0014] The heating device 10 consists of a radiator having horizontal tubular elements 11, preferably of circular cross-section, which are connected by welding to a pair of vertical tubular elements 12,13 having a rectangular cross-section. The heating device 10 is floor- or wall mounted and is connected to the hot water circuit of the domestic heating system. The heating device can be also provided with an electric resistor for heating the water in the case the domestic heating system is not operating.

[0015] Inside the heating device 10 water is circulated which enters through an inlet pipe 14 connected to the vertical tubular element 12 and, after flowing through the horizontal tubular elements 11, exits through an outlet pipe 15 connected to the vertical tubular element 13.

[0016] As shown in Figures 2 and 3, each vertical tubular element 12,13 of the heating device is provided with a series of bores 16 formed in the facing surfaces of the vertical tubular elements and adapted to receive the end portions of the horizontal tubular elements 11.

[0017] In Figure 4 there is depicted a partial longitudinal sectional view of a first embodiment of the horizontal tubular element showing one of its two end portions 17. As can be seen, each end portion 17 of the horizontal tubular element is machined so as to form a cylindrical circular portion 18 having an outer diameter which is slightly smaller than the outer diameter of the horizontal tubular element and of the diameter of the bores 16 formed in the vertical tubular elements 12,13. The cylindrical circular portion 18 of the horizontal tubular element is joined to the remaining portion thereof through an annular shoulder 19 formed at a fixed distance from the end portion of the tubular element. The annular cylindrical circular portion 18 of the horizontal tubular element is obtained by means of a machining process, typically using a turning machine tool.

[0018] In Figure 5 there is shown a partial longitudinal sectional view of one of the two end portions 17 of the horizontal tubular element according to another embodiment of the present invention. Also in this embodiment, each end portion 17 of the horizontal tubular element is provided with a cylindrical circular portion 18 having an outer diameter which is slightly smaller than the outer diameter of the horizontal tubular element and of diam-

eter of the bores 16 formed in the vertical tubular elements 12,13. The cylindrical circular portion 18 of the horizontal tubular element is joined to the remaining portion thereof through an annular shoulder 19 formed at a fixed distance from the end portion of the horizontal tubular element. In this embodiment, the annular cylindrical circular portion 18 of the horizontal tubular element is obtained by means of a forming process, and particularly a compressive forming process.

[0019] Referring now to Figures 6 and 7 of the drawings, there is shown a partial cross-sectional view of a horizontal tubular element 11 connected to one of the vertical tubular elements 12,13 of the heating device 10. As can be seen, each end portion 17 of the horizontal tubular element is inserted in a bore 16 of the vertical tubular elements until the annular shoulder 19 of the end portion 17 abuts against the edge of the bore 16. At the edge of the bore 16 a weld material 20 is applied in the minimum required quantity necessary for assuring a firm joining of the end portion 17 of the horizontal tubular element to the vertical tubular elements 12,13. In Figure 6 of the drawings, the end portion 17 of the horizontal tubular element, after being inserted in one of the bores 16 of the vertical tubular element, undergoes a further forming process by which a flaring 21 is formed with the purpose of keeping in a fixed position the end portion 17 of the horizontal tubular element during the welding operation.

[0020] From the foregoing it can be understood that the heating device achieves the aimed object. In particular, the machining or forming process performed on the end portions of the horizontal tubular elements permits an easy and accurate assembly thereof together with vertical tubular elements of the heating device and permits a high manufactural quality to be achieved because the gap formed between the edge of the bores in which the end portions of a horizontal tubular element are inserted and the surface of the horizontal tubular element is much narrower than that obtained with horizontal tubular elements having a frusto-conical end portion, thereby also the quantity of weld material required for filling the gap, although small, is sufficient for filling the gap. Furthermore, the machining or forming process performed on the end portions of the horizontal tubular elements is rather simple and inexpensive to carry out.

Claims

1. A heating device for heating domestic rooms and/or for drying household linens of the kind intended to be connected to the hot water circuit of a domestic heating system and provided with an array of horizontal tubular elements (11) which are joined by welding to a pair of vertical tubular elements (12,13), wherein said vertical tubular elements (12,13) are provided with a plurality of bores (16) which are adapted to receive the end portions (17)

of the horizontal tubular elements (11), **characterised in that** the end portions (17) of the horizontal tubular elements (11) are provided with a reduced diameter cylindrical portion (18) adapted to be inserted in the bores (16) formed in the vertical tubular elements (12,13), said cylindrical portion (18) having a shoulder (19) at the connection with the outer surface of the horizontal tubular element (11) which is adapted to abut against the edge of the bores (16) during the assembly of the heating device.

2. A heating device according to claim 1, **characterised in that** the cylindrical portion (18) of the horizontal tubular elements (11) is obtained by means of a machining process.
3. A heating device according to claim 1, **characterising in that** the cylindrical portion (18) of the horizontal tubular elements (11) is obtained by means of a forming process, particularly a compressive forming process.
4. A heating device according to claim 1, **characterised in that** upon insertion of the end portions (17) of the horizontal tubular elements (11) in the bores (16) of the vertical tubular elements (12,13) a flaring (21) is performed by means of a forming process, said flaring (21) being adapted to keep in a fixed position the horizontal tubular element (11) during the welding operation of the end portions (17) thereof to the vertical tubular elements (12,13).

FIG. 1

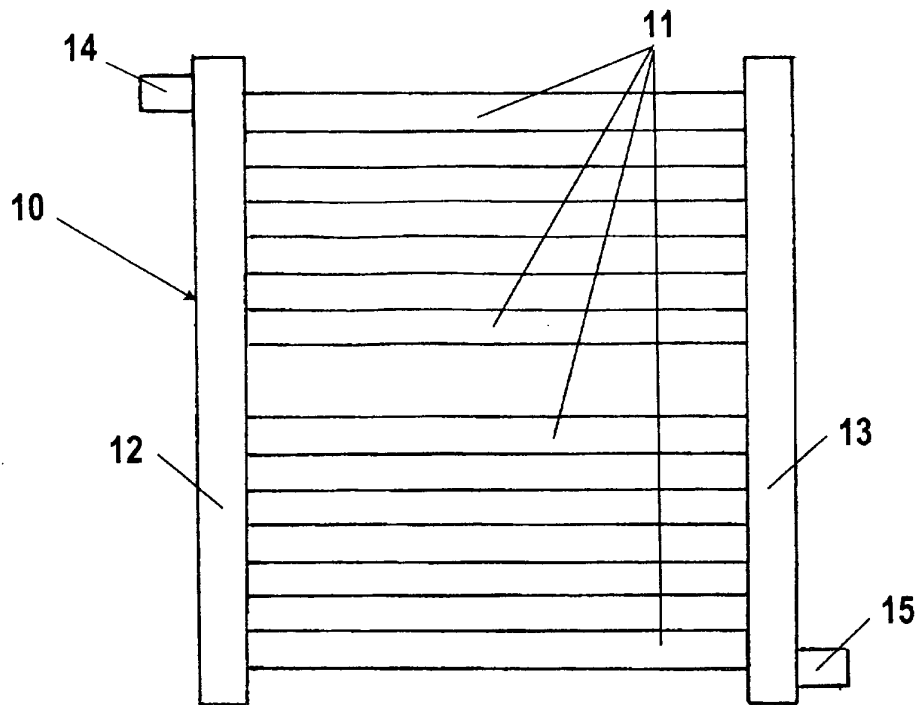


FIG. 2

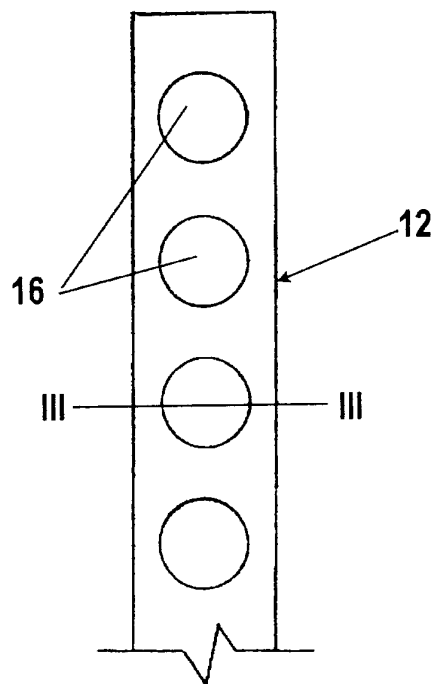


FIG. 3

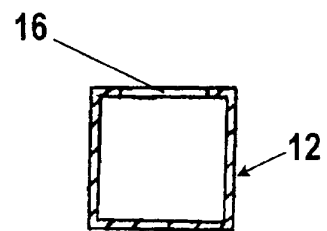


FIG. 4

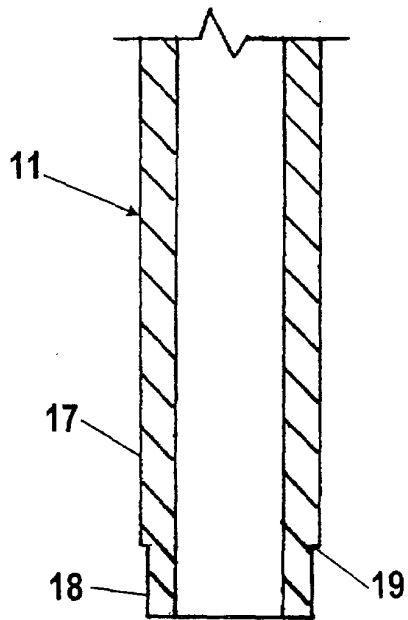


FIG. 5

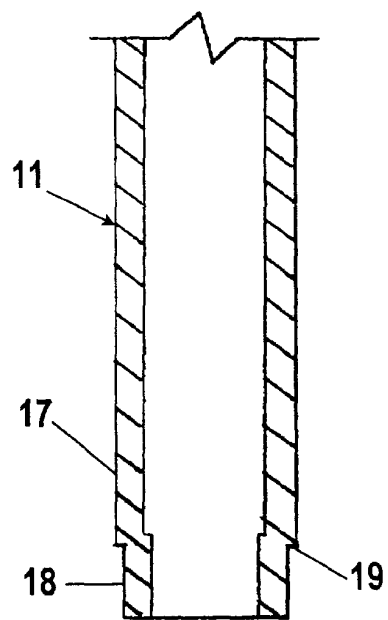


FIG. 6

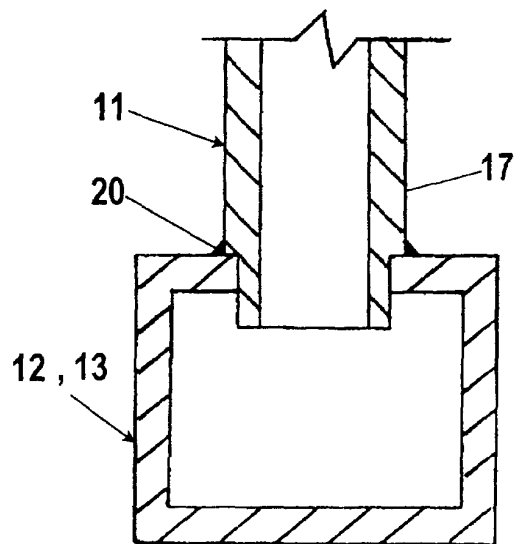


FIG. 7

